

BAB XII

PERENCANAAN GORDING

12.1 Pembebanan Gording

- Penutup atap Genteng
- Berat penutup atap $w_g := 50 \text{ kg/m}^2$
- jarak antar gording $l_g := 120 \text{ cm}$
- bentang gording $l_k := 360 \text{ cm}$
- sudut kemiringan 42°

Direncanakan Gording profil C dengan ukuran : 150 x 50 x 20 x 2.3

$A := 6.32 \text{ cm}^2$	$t := 2.3 \text{ mm}$	$S_x := 28 \text{ cm}^3$
$W := 4.96 \text{ kg/m}$	$I_x := 210 \text{ cm}^4$	$S_y := 6.3 \text{ cm}^3$
$h := 150 \text{ mm}$	$I_y := 2 \text{ cm}^4$	
$b := 50 \text{ mm}$	$Z_x := 28 \text{ cm}^3$	
$i_x := 5.77 \text{ cm}$	$Z_y := 6.3 \text{ cm}^3$	
$i_y := 1.86 \text{ cm}$	$r := 10 \text{ mm}$	

Mutu Baja BJ 37

$f_y := 240 \text{ Mpa}$

$f_u := 370 \text{ Mpa}$

• Perhitungan Pembebanan

• Beban Mati

berat gording	$W = 4.96$	kg/m
berat genteng, reng, dan usuk (PPIUG 1971)	$w_g := 50 \cdot 1.2 = 60$	kg/m
	$wt := W + w_g = 64.96$	kg/m
berat pengikat 10 %	$wp := 0.1 \cdot wt = 6.5$	kg/m
berat plafond & penggantung	$wpl := 18$	kg/m
	$qd := wt + wp + wpl = 89.46$	kg/m

• Momen akibat beban mati (M_d)

$$M_{xd} := \frac{q_d}{8} \cdot \cos\left(\frac{\pi}{4.29}\right) \cdot 3.6^2 = 107.77 \text{ kgm}$$

$$M_{yd} := \frac{q_d}{8} \cdot \sin\left(\frac{\pi}{4.29}\right) \cdot 1.2^2 = 10.77 \text{ kgm} \quad (\text{pasang 2 penggantung})$$

• Beban Hidup

1. Beban hidup terbagi rata (air hujan)

$W_1 := (40 - 0.8 \cdot 42) = 6.4 \text{ kg/m}^2$ diambil 6.4 kg/m^2

$$q_l := 1.2 \cdot \cos\left(\frac{\pi}{12.8}\right) \cdot 6.4 = 7.45 \text{ kg/m'}$$

$$M_{x1} := \frac{\left(q_l \cdot \cos\left(\frac{\pi}{4.29}\right) \cdot 3.6^2 \right)}{8} = 8.97 \text{ kgm}$$

$$M_{y1} := \frac{\left(q_l \cdot \sin\left(\frac{\pi}{4.29}\right) \cdot 1.2^2 \right)}{8} = 0.9 \text{ kgm} \quad (\text{pasang 2 penggantung})$$

2. Beban hidup terpusat

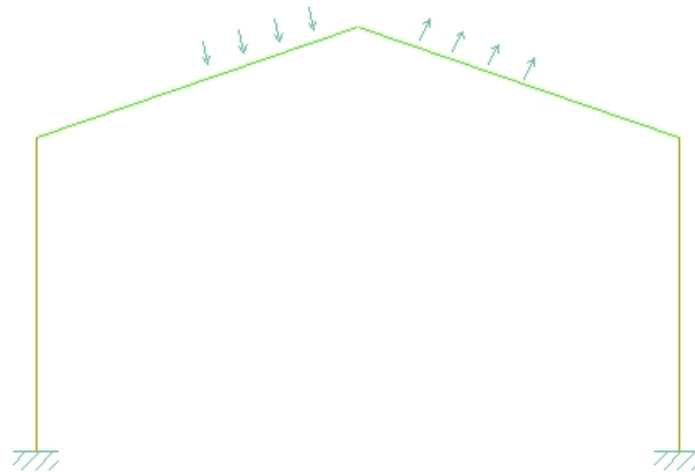
$$M_{xlp} := \frac{100}{4} \cdot \cos\left(\frac{\pi}{4.29}\right) \cdot 3.6 = 66.93 \text{ kgm}$$

$$M_{y lp} := \frac{100}{4} \cdot \sin\left(\frac{\pi}{4.29}\right) \cdot 1.2 = 20.06 \text{ kgm} \quad (\text{pasang 2 penggantung})$$

- Beban Angin (bangunan tertutup) $w_a := 25 \text{ kg/m}^2$ (jauh dari pantai)

$C = 0.02 \text{ to } 0.4$ (angin tekan)

$C = -0.4$ (hisap)



angin tekan $q_{w1} := (0.02 \cdot 42 - 0.4) \cdot w_a = 11 \text{ kg/m}^2$ (diabaikan)

angin hisap $q_{w2} := -0.4 \cdot w_a = -10 \text{ kg/m}^2$ (hisap)

$$q_d + q_l = 96.91 \text{ kg/m}^2 > 10 \text{ kg/m}^2$$

$$M_{xw} := \frac{\left(q_{w1} \cdot \cos\left(\frac{\pi}{4.29}\right) \cdot 3.6^2 \right)}{8} = 13.25 \text{ kgm}$$

$$M_{yw} := \frac{\left(q_{w1} \cdot \sin\left(\frac{\pi}{4.29}\right) \cdot 1.2^2 \right)}{8} = 1.32 \text{ kgm} \quad (\text{pasang 2 penggantung})$$

- Beban berfaktor (beban mati + beban hidup + angin)

$$M_{ux} := 1.2 \cdot M_{xd} + 1.6 \cdot M_{xlp} + 0.8 \cdot M_{xw} = 247 \text{ kgm}$$

$$M_{uy} := 1.2 \cdot M_{yd} + 1.6 \cdot M_{y lp} + 0.8 \cdot M_{yw} = 46.07 \text{ kgm}$$

- Kontrol Tegangan Gording

$$\sigma := \frac{M_{ux} \cdot 100}{Z_x} + \frac{M_{uy} \cdot 100}{\left(\frac{Z_y}{3}\right)} = 1596.43 \frac{\text{kg}}{\text{cm}^2} \quad \blacksquare < \blacksquare \quad \sigma_{ijin} := 1600 \frac{\text{kg}}{\text{cm}^2}$$

12.2 Kontrol kekuatan profil C 150 x 50 x 20 x 2.3

$$M_y := S_x \cdot \frac{f_y}{10} = 672 \text{ kgm}$$

$$M_n := M_y = 672 \text{ kgm}$$

$$\Phi M_n := 0.9 \cdot M_n = 604.8 \text{ kgm} \quad \blacksquare \geq \blacksquare \quad M_{ux} = 175 \text{ kgm} \quad \text{OK!!}$$

- Kontrol kuat geser (bentang pendek)

$$d := h - 2 \cdot (t + r) = 125.4 \text{ mm}$$

$$\frac{h}{t} = 65.22 \quad \frac{h}{t} < \frac{1100}{\sqrt{f_y}} \quad \text{-----> Plastis}$$

$$\frac{1100}{\sqrt{f_y}} = 71$$

- Bentang pendek

$$R_d := 0.5 \cdot q_d \cdot 3.6 = 161.02 \text{ kg}$$

$$R_l := 100 \text{ kg}$$

$$R_u := 1.2 \cdot R_d + 1.6 \cdot R_l = 353.22 \text{ kg}$$

$$V_n := 0.6 \cdot 2400 \cdot \frac{(t \cdot d)}{100} = 4153.25 \text{ kg}$$

$$\phi V_n := 0.9 \cdot V_n = 3737.92 \text{ kg} > R_u = 353.22 \text{ kg} \quad \text{OK}$$

- Kontrol Lendutan

$$\text{Lendutan ijin :} \quad f := \frac{360}{180} = 2 \text{ cm}$$

- Lendutan akibat beban terbagi rata

$$f_{x1} := \frac{5 \cdot \left(q_d \cdot \cos\left(\frac{\pi}{4.29}\right) \cdot 360^4 \right)}{384 \cdot 2 \cdot 10^6 \cdot I_x \cdot 100} = 0.35 \text{ cm}$$

$$f_{y1} := \frac{5 \cdot \left(q_d \cdot \sin\left(\frac{\pi}{4.29}\right) \cdot 120^4 \right)}{384 \cdot 2 \cdot 10^6 \cdot I_y \cdot 100} = 0.404 \text{ cm}$$

- Lendutan akibat beban terpusat

$$f_{x1} := \frac{\left(100 \cdot \cos\left(\frac{\pi}{4.29}\right)\right) \cdot 360^3}{40 \cdot 2 \cdot 10^6 \cdot I_x} = 0.21 \text{ cm}$$

$$f_{y1} := \frac{\left(100 \cdot \sin\left(\frac{\pi}{4.29}\right)\right) \cdot 120^3}{40 \cdot 2 \cdot 10^6 \cdot I_y} = 0.72 \text{ cm}$$

- Lendutan total

$$f_{tot} := \sqrt{(f_{x1} + f_{x1})^2 + (f_{y1} + f_{y1})^2} = 1.25 \text{ cm} < f = 2 \text{ cm} \quad \text{OK!!}$$

12.3 Perencanaan Penggantung Gording

$s := 1.20 \text{ m}$ (jarak antar gording)

$L := 3.6 \text{ m}$ (jarak antar kuda - kuda)

$l_p := 1.2 \text{ m}$ (jarak penggantung)

$$\sin \Phi := \frac{s}{\sqrt{s^2 + l_p^2}} = 0.71$$

$$\sin \alpha := 0.574$$

- Luas horizontal atap $A_{tp} := 3.6 \cdot 1.2 = 4.32 \text{ m}^2$
 Beban mati $q_D := A_{tp} \cdot q_d = 386.45 \text{ kg}$
 Beban hidup $q_L := 6.4 \cdot A_{tp} = 27.65 \text{ kg}$
 $N_D := q_D \cdot \sin \alpha = 221.82 \text{ kg}$
 $N_L := q_L \cdot \sin \alpha = 15.87 \text{ kg}$
 $T_D := \frac{N_D}{\sin \Phi} = 313.7 \text{ kg}$
 $T_L := \frac{N_L}{\sin \Phi} = 22.44 \text{ kg}$

- Beban berfaktor

$$T_u := 1.2 \cdot T_D + 1.6 \cdot T_L = 412.354 \text{ kg}$$

- Dimensi pengikat gording

$$\text{Batas kelangsingan} \quad D \geq \frac{110}{500} = 0.22 \text{ cm}$$

$$\text{Batas leleh} \quad A_{g1} := \frac{T_u}{0.9 \cdot 2400} = 0.19 \text{ cm}^2$$

Batas putus

$$Ag2 := \frac{T_u}{0.75 \cdot 0.75 \cdot 2400} = 0.31 \text{ cm}^2 \quad \text{menentukan!!}$$

$$D := \sqrt{\frac{4 \cdot Ag2}{\pi}} = 0.62 \text{ cm}$$

pakai pengikat dengan $\Phi 10$